LIFE HISTORY OF PORELLA PLATYPHYLLA

CONTRIBUTIONS FROM THE HULL BOTANICAL LABORATORY 184

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(WITH PLATES XV AND XVI)

There was no definite knowledge of the morphology of *Porella* until CAMPBELL (3) published an account of the life history of *P. Bolanderi* in 1904. Under the name *Madotheca*, LEITGEB (7) published a few figures of the apical situation. ENGLER and PRANTL (5) barely mention the group to which it belongs, and in their classification it receives the name *Bellincinia* (under the group Bellincinioideae). From 1904 to 1908, the literature is bare of any mention of *Porella*, that is, so far as its life history is concerned. In 1908, ANDREWS (1) accidentally discovered an abnormal situation in the archegonium, finding one with two axial rows, each containing the same number of neck canal cells, and each with a ventral canal cell and an egg. He reported the fact without drawing any conclusion as to its probable meaning. All investigators who have worked with *Porella* agree in regarding it as of high rank among the acrogynous Jungermanniales.

MATERIAL AND METHODS.—The material for the present investigation was collected by Dr. W. J. G. LAND, and some of it had been in the laboratory in a dried condition for several years. In order to revive it, it was soaked for 24 hours in water at a temperature of about 31° C. At the end of this period, it was as fresh as though it had never been dried; and the subsequent examination of the imbedded material showed that it had suffered no ill effects. This ability of liverworts to revive after a long period of desiccation has long been known. CAMPBELL (2) experimented with some Californian liverworts and found them able to recover after having been dried for months. No satisfactory explanation of this phenomenon has been given. GOEBEL (6) mentions the various devices of leafy liverworts for holding water for a long period, such as tubers, water sacs, etc., but this does not explain the power of revival after desiccation.

After the material had been revived, the branches bearing sex organs and those bearing sporophytes were killed in 0.25 per cent chromo-acetic acid, imbedded, and cut in sections 6–8 μ thick. The stains used were safranin, gentian-violet, and orange G; safranin and anilin blue; and iron alum-hematoxylin.

APICAL CELL AND VEGETATIVE BODY.—The apical cell is pyramidal, a type found throughout the Jungermanniales. By pyramidal is meant a cell whose cross-section is an isosceles triangle, and that has three cutting faces. Branches may arise from the latest segment of the cutting cell (fig. 1).

The leafy body is dorsiventral and recumbent, with two dorsal leaves and one ventral leaf (amphigastrium). The dorsal leaves have ventral lobes, which give to the ventral surface the appearance of having three rows of leaves.

The sex organs are borne on short lateral branches, those bearing archegonia being shorter than those bearing antheridia. The sporophyte is surrounded by a cluster of broad leaves.

ARCHEGONIUM (figs. 2–9).—The archegonium arises as a papillate cell from the segment of the apical cell or from the apical cell itself. The first division is transverse; the inner cell is the stalk cell, which does not divide until late in the development of the archegonium; the outer cell forms the archegonium. The first division of this outer cell is vertical, followed by two more vertical walls in rapid succession, cutting off a central cell. Transverse division of the central cell results in the cap cell and the cell which produces the axial row. Divisions of the peripheral cells form a jacket about the central cell and its progeny. The axial row comprises 4–6 neck canal cells in addition to the ventral canal cell and egg.

In the material studied, there was found an abnormal archegonium such as ANDREWS (1) reported (fig. 9). Whether such an archegonium has any bearing upon the question of the origin of the archegonium or not remains to be seen. In any event, it would fit well into the series of hypothetical sketches by DAVIS (4), connecting a gametangium ("plurilocular sporangium") of the brown algae with an archegonium of the liverworts. Miss LYON (8) has described cases of archegonia among the pteridophytes with lateral multiplication of the cells of the axial row.

ANTHERIDIUM (figs. 15–27).—The antheridium arises as a papillate cell from a segment of the apical cell, but never from the apical cell itself. The first division is transverse, the inner cell being the stalk cell, and the outer cell producing the spermatogenous cells and the jacket. The next wall may divide the stalk cell transversely, or both stalk cell and outer cell may divide vertically. If the first division of the outer cell is not by a vertical wall, vertical walls appear in the next two divisions. Periclinal walls then differentiate jacket and spermatogenous tissue. The jacket becomes several cells thick by periclinal divisions, and by further divisions the spermatogenous tissue appears as blocklike masses of cells. At maturity, the stalk of the antheridium is long and slender, and uniformly two cells in thickness.

SPOROPHYTE (figs. 10–14).—Only mature stages of the sporophyte were represented in the material. Great variation in the shape of the foot was observed, from the club-shaped foot illustrated by CAMPBELL (3) to a more or less definite anchor-shaped foot. There is no elaterophore, or any grouping of the elaters, but a general distribution of elaters through the capsule.

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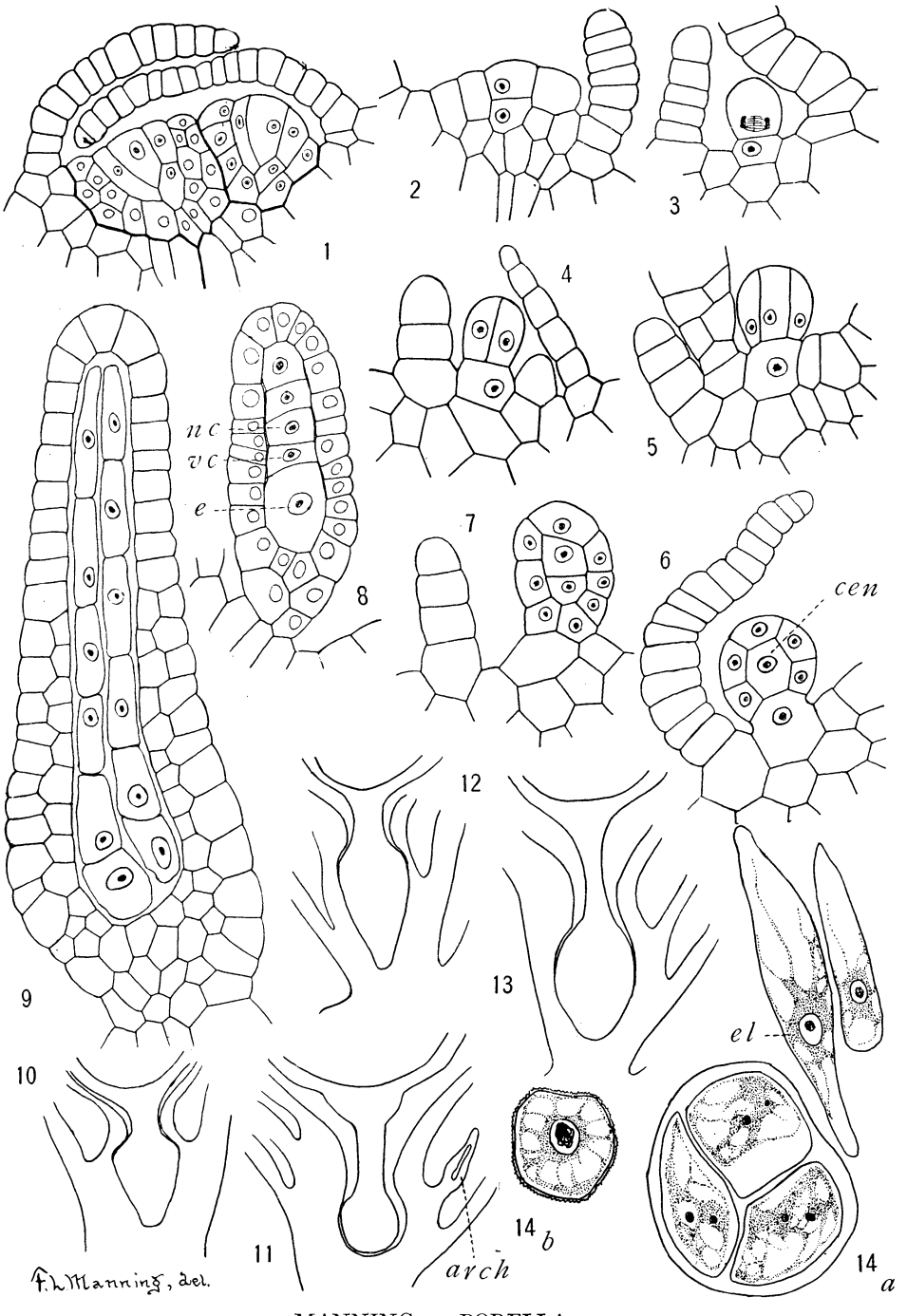

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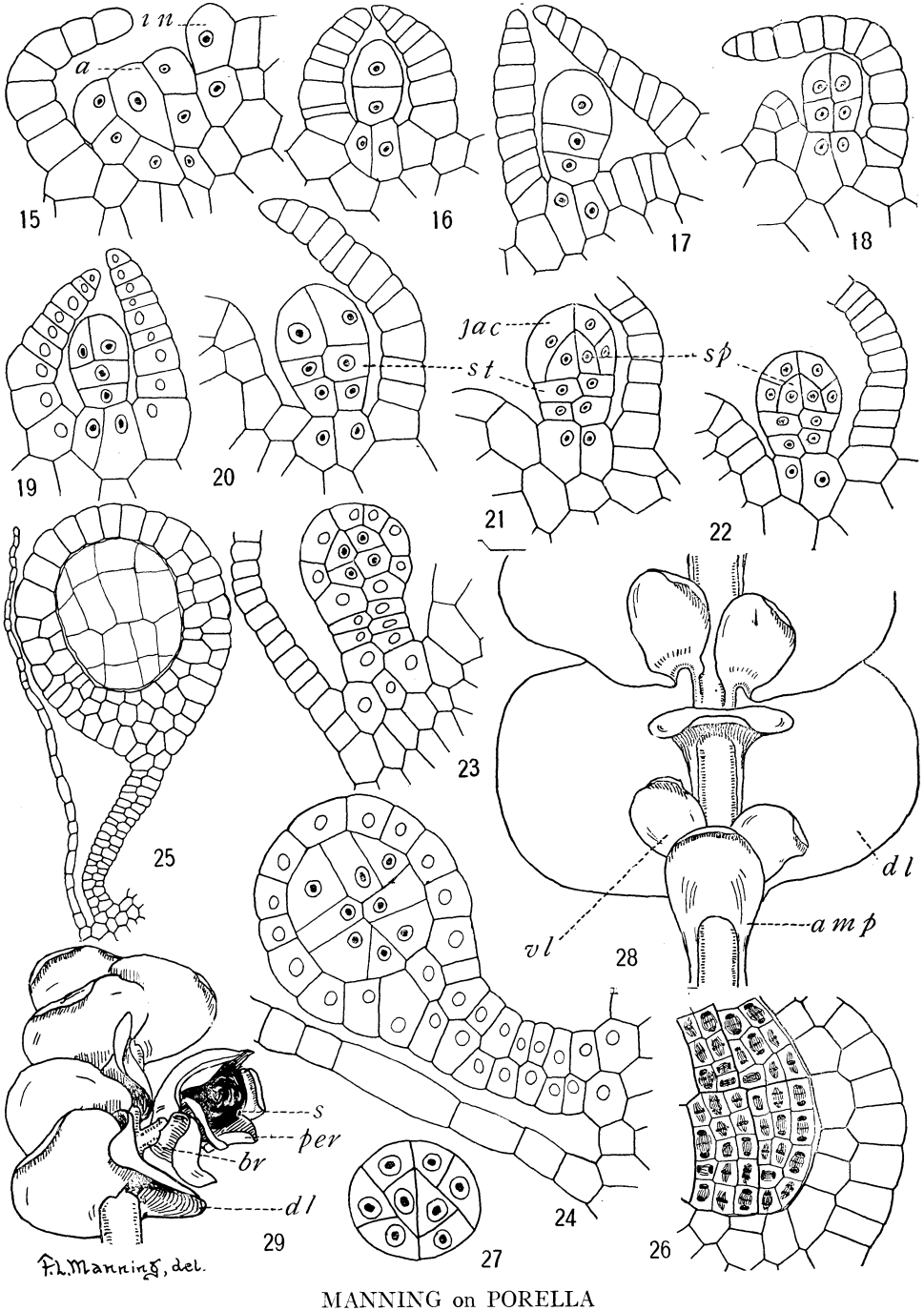

MANNING on PORELLA

EXPLANATION OF PLATES XV AND XVI

All figures were drawn with a camera lucida, except figs. 25, 28, and 29, and reduced one-half in reproduction. The magnifications appearing in the plates are as follows: figs. 1–8, 14–24, and 27, ×329; figs. 9 and 26, ×115; figs. 10–13, ×22.5.

FIG. 1.—Apical cells, showing branching.

FIGS. 2–9.—Archegonium series.

FIG. 2.—First transverse division of initial.

FIG. 3.—Spindle of first vertical division.

FIG. 4.—First vertical wall in outer cell.

FIG. 5.—Second vertical wall; probably a third one in plane of plate completes the cutting-off of a central cell.

FIG. 6.—Central cell (*cen*) has cut off cap cell; peripheral cells have divided to form jacket.

FIG. 7.—First division of central cell.

FIG. 8.—The axial row, comprising three neck canal cells (*nc*), ventral canal cell (*vc*), and egg (*e*).

FIG. 9.—Mature stage of an abnormal archegonium showing two distinct axial rows.

FIGS. 10–14.—Sporophyte series.

FIGS. 10–13.—Various forms of the foot.

FIG. 14, *a*.—Sporogenous tissue at tetrad stage, before elaters (*el*) are coiled.

FIG. 14, *b*.—Mature spore before shedding.

FIGS. 15–27.—Antheridium series.

FIG. 15.—Antheridial initial (*in*) cut off from the last segment of the apical cell (*a*).

FIG. 16.—First transverse division of the initial cell.

FIG. 17.—The second transverse division; this division may be either transverse or vertical.

FIG. 18.—A case in which the second division was vertical.

FIG. 19.—In this case the second division was transverse, followed by a vertical division in the upper cell; the two lower cells are the stalk cells.

FIG. 20.—Vertical divisions of the stalk cells (*st*).

FIG. 21.—The first periclinal walls cutting off spermatogenous tissue (*sp*).

FIG. 22.—Further division of jacket cells; *sp*, spermatogenous tissue.

FIG. 23.—Division of spermatogenous cells by transverse walls.

FIG. 24.—Further division of spermatogenous tissue and elongation of stalk.

FIG. 25.—Mature antheridium showing blocking of spermatogenous tissue, division of jacket cells by periclinal walls, and the slender stalk consisting of two rows of cells.

FIG. 26.—Portion of a mature antheridium showing simultaneous division of spermatogenous cells.

FIG. 27.—Cross-section of antheridium at stage shown in fig. 22.

FIG. 28.—Ventral view of gametophyte with one of the amphigastria (upper one) turned back to show the lobing of the dorsal leaves; *amp*, amphigastrium; *dl*, dorsal lobe; *vl*, ventral lobe.

FIG. 29.—Dorsal view of gametophyte with one of the dorsal lobes (*dl*) turned back so as to show sporophyte branch (*br*); *per*, perichaetium; *s*, sporophyte.